

U.S. Patent Application No. 10/042,549  
Amendment dated February 8, 2007  
Reply to Office Action of August 10, 2006

### **REMARKS/ARGUMENTS**

Reconsideration and continued examination of the above-identified application are respectfully requested.

By way of this amendment, claims 9, 14-17, 44, and 49-52 have been canceled. New claims 96-101 have been added. Full support for new claims 96-101 can be found in the present application as originally filed, such as at pages 5, 6, 7, 10, and in the examples of the present application. Also, in this amendment, claims 2, 18, 23, 28, 37, 53, 58, 63, 89, 90, 91, 92, 93, 94, and 95 have been amended. Entry of the amendment is respectfully requested.

#### **Claim Objection to Claim 95**

At page 2 of the Office Action, the Examiner objects to claim 95 for clarity reasons. In response, claim 95 has been amended to recite that the range of "not exceeding" 20 is directed to the aspect ratio of the longitudinal grains.

Accordingly, this objection should be withdrawn.

#### **Rejection of Claims 2 - 14, 16, 17, 89 - 90, and 95 under 35 U.S.C. §103(a) over Clark et al. and WO 87/07650 (WO '650)**

Claims 2 - 14, 16 - 17, 89 - 90, and 95 were rejected under 35 U.S.C. §103(a) as being obvious over Clark et al., "Influence of Transverse Rolling on the Microstructural and Textural Development of Pure Tantalum," in view of WO 87/07650 (WO '650). The Examiner referred to the previous final Office Action wherein the Examiner alleged that Clark et al. teaches an extruded tantalum billet having a substantially uniform grain size. The Examiner acknowledged that Clark et al. does not explicitly teach the claimed purity, the metal in the article, the

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sputtering target or resistive film layer, but alleged that WO '650 teaches the purity claimed in claims 2, 7, and 12 and the metal in a sputtering target and a resistive film layer. The Examiner further alleged that WO '650 teaches that the use of highly pure tantalum in the formation of the target results in a high-quality oxide insulating film and metallic tantalum electrode film. The Examiner took the position that it would have been obvious to use the high purity tantalum material of WO '650 in the process of Clark et al. in order to provide Clark et al. with the desirable result of providing a material that, when formed into a tantalum sputtering target as taught in WO '650, yields a high quality oxide insulating film and metallic tantalum electrode film. In the present Office Action, with respect to amended claim 2, the Examiner alleged that Clark et al. teaches that the tantalum ingot is extruded and annealed. The Examiner takes the position that since annealing is not a thermomechanical process, the extruded and annealed tantalum of Clark et al. meets the limitation of having "a substantially uniform average grain size after extrusion and before any further thermomechanical processing."

Further, in the rejection, the Examiner asserted that such language as "extruded" and "after extrusion and before any further thermomechanical processing" are process limitations which do not lend patentability to the product claims to 2-14 and 16-17.

This rejection is respectfully traversed as it may be applied to the amended claims presented herein.

With respect to the product claims, including claim 2 and the claims dependent on claim 2, claim 2 recites an extruded tantalum billet having a cylindrical shape and, further, the extruded tantalum billet has a diameter that is at least 2 ½ inches and has an aspect ratio L/D of greater than 0.5. Further, claim 2 recites that the tantalum billet is ingot-derived material, as opposed to powder-metallurgy material and, further, has a purity of at least about 99.99%. Claim 2 further

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recites that the tantalum billet has a substantially uniform grain size as that term is understood as defined in the present specification and as acknowledged by the Examiner.

Unlike claim 2, Clark et al. shows an extrusion of a VAR ingot directly to a rolling bar. See Fig. 2, Process No. 3, page 2184, of Clark et al. No other teaching or suggestion of extruded material is shown or suggested in Clark et al. Thus, unlike Clark et al., the present application relates to a cylindrical shaped extruded billet having desirable properties as recited in claim 2 and, clearly, this is not the case in Clark et al., which relates to an extruded flat, rectangular rolling bar. Further, WO '650 does not overcome these deficiencies since WO '650 does not relate to extruded material and, further, does not relate to an extruded billet having a cylindrical shape with the properties recited in claim 2.

It is further respectfully noted that the VAR ingot of Clark et al. could in no way have the properties set forth in claim 2 since no mechanical working of the ingot has occurred and the ingot is simply a result of melting tantalum powder to form an ingot in a mold. There would be no teaching or suggestion in Clark et al. which sets forth a billet having a cylindrical shape with the properties recited in claim 2, as well as the claims dependent on claim 2.

In addition, the applicants rely on the differences between the claimed invention and Clark et al. in view of WO '650 as presented in the Amendment filed June 9, 2006 and those comments are incorporated in their entirety by reference herein to avoid repeating them.

With respect to claims 16 and 17 of the present application, these claims have been canceled by way of this amendment.

With respect to claims 89 and 90 of the present application, these claims recite a process of making an extruded tantalum billet and specifically recite the step of extruding a tantalum ingot having a cylindrical shape with a diameter of 6 inches to about 14 inches or extruding a

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starting tantalum billet having a cylindrical shape with a diameter of 6 inches to about 14 inches to form an extruded tantalum billet having a cylindrical shape with a reduced diameter of 2 ½ inches or greater, and then subjecting the extruded tantalum billet having a cylindrical shape to sufficient temperature or sufficient time to at least partially recrystallize the extruded tantalum billet. Claim 90 recites a similar step, but specifically recites an "annealing" step. Claims 89 and 90 further recite a metal purity of at least 99.99% and that the extruding results in a substantially uniform grain size as that term is understood in the present application. Again, these process steps are not shown in Clark et al. alone or in combination with WO '650 for the reasons discussed above. In particular, Clark et al. again does not show a process which extrudes a billet or an ingot to result in an extruded billet having a cylindrical shape with reduced diameter and having the properties recited in the process claims. WO '650 does not overcome these deficiencies as described above. Also, Clark et al. does not even start with an ingot having a diameter of 6 inches or greater, which would also affect the end properties.

With respect to claim 95, this claim is dependent on claim 2 and is a property of the extruded tantalum billet having a cylindrical shape and Fig. 8, relied upon by the Examiner, relates to the microstructures of the rolled bar or plate and, therefore, is not a microstructure of a billet having a cylindrical shape. Furthermore, the particular microstructure shown in Fig. 8(c) in no way can be understood to show an aspect ratio of the longitudinal grains not exceeding 20. While the Examiner indicates that the Examiner concluded this, the information is not sufficient in the figures to make such a conclusion. However, in view of the fact that Fig. 8 does not even relate to an extruded billet having a cylindrical shape, the Examiner's reasoning for rejecting claim 95 would not be sufficient to maintain the rejection of claim 95 in view of Clark et al. and WO '650.

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For these reasons, this rejection should be withdrawn.

**Rejection of Claims 18 - 35, 71 - 79, and 91 under 35 U.S.C. §103(a) over Clark et al. and WO 87/07650 (WO '650) in further view of Friedman et al.**

Claims 18 - 35, 71 - 79, and 91 were rejected under 35 U.S.C. §103(a) as being obvious over Clark et al. and WO '650 in further view of Friedman et al. (U.S. Patent No. 5,482,672). The Examiner referred to the previous final Office Action in which the Examiner stated that Clark et al. and WO '650 are applied as discussed above, and acknowledged that these references do not explicitly teach the particular extrusion conditions. The Examiner alleged that Friedman et al. teaches the extrusion of tantalum and niobium ingots, including the temperature of extrusion, the coating of the material and the removal of the coating and that the reference teaches that extrusion is advantageous to make bars, rods and tubes out of difficult to make metals such as tantalum and niobium. The Examiner took the position that it would have been obvious to use the particular processing conditions of Friedman et al. to provide rods, bars and tubes of tantalum or niobium. The Examiner further alleged that regarding recrystallization, Friedman et al. teaches the same process steps and that therefore, one would expect the products resulting from the process taught by the reference to be the same as the products from the claimed process. This rejection is respectfully traversed.

Claim 18 recites a process for making the extruded tantalum billet of claim 2. Claim 18 specifically recites the step of extruding a tantalum ingot having a cylindrical shape with a diameter of 6 inches to about 14 inches and a metal purity of at least about 99.99%, wherein this extruding results in an extruded tantalum billet having a cylindrical shape with a reduced diameter of 2 ½ inches or greater and having a substantially uniform grain size as a result of the

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extrusion. Claim 18 further recites that recrystallization occurs during this extruding process.

As indicated above, Clark et al. does not relate to a process of extruding a tantalum ingot to form an extruded tantalum billet having a cylindrical shape. Clark et al. also shows a starting ingot diameter well below 6 inches. As indicated above, Clark et al. shows the extruding of an ingot to form a rectangular rolling bar. Clearly, the process of Clark et al. is quite different from claim 18 and the claims dependent on claim 18. Furthermore, as indicated, WO '650 does not overcome the deficiencies of Clark et al. Also, Friedman et al. does not overcome the deficiencies of Clark et al. for the reasons provided in the response filed June 9, 2006, the comments of which are entirely incorporated by reference herein. As stated, Friedman et al. relates to powder metallurgy products and not ingot-derived material. Furthermore, it is pointed out that Friedman et al. forms a billet from powder through cold isostatic pressing and then extrudes into a bar as discussed, for instance, at cols. 4 and 5 of Friedman et al. A bar is not a billet with a cylindrical shape. In addition, none of the cited references teach or suggest a process which extrudes to form an extruded billet having a cylindrical shape with a reduced diameter and obtaining a substantially uniform grain size as a result of the extruding.

Furthermore, none of the cited references show the additional step of water quenching the extruded tantalum billet after extrusion as recited in claim 21 of the present application. For the same reasons, claims 23-27 would not be taught or suggested by the cited references due to similar language in claim 23. This is also true for claims 28-35. In addition, none of the cited references teach or suggest claim 35, which relates to a protective coating being removed by acid washing or machine cleaning or both. Similarly, claims 71-79 are dependent indirectly or directly on claim 18, and for the same reasons would be patentable over the cited references, in addition to the limitations set forth in each of these claims.

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Also, claim 91 recites similar limitations to claim 18, and for these same reasons would be patentable over the cited references.

Accordingly, for these reasons, this rejection should be withdrawn.

**Rejection of Claim 15 under 35 U.S.C. §103(a) over Clark et al. and WO 87/07650 (WO '650) in further view of Rerat**

Claim 15 was rejected under 35 U.S.C. §103(a) as being obvious over Clark et al. and WO '650 in further view of Rerat (U.S. Patent No. 4,149,876). The Examiner states that Clark et al. and WO '650 are applied as discussed above, and acknowledges that these references do not explicitly teach a capacitor can. The Examiner alleges that Rerat teaches that tantalum and niobium are desirable materials for forming capacitor components, including a capacitor can. The Examiner takes the position that it would have been obvious to use the material of Clark et al. to form capacitor parts because the formation of capacitor parts from tantalum and niobium is well-known, as shown in Rerat, wherein tantalum and niobium provide desirable electrical properties to the capacitors. This rejection is respectfully traversed.

As indicated above, claim 15 has been canceled by way of this amendment and, accordingly, this rejection is moot.

**Rejection of Claims 37 - 49, 51 - 70, 80 - 88, and 92 - 94 under 35 U.S.C. §103(a) over Clark et al. in view of Friedman et al. and in further view of JP '180**

Claims 37 - 49, 51 - 70, 80 - 88, and 92 - 94 were rejected under 35 U.S.C. §103(a) as being obvious over Clark et al. in view of Friedman et al. and in further view of JP 362104180 A (JP '180). The Examiner referred to the rejection grounds given in paragraph 8 of the Office Action dated January 25, 2005.

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The Examiner alleged that although Clark et al.'s teaching is directed to tantalum, one of ordinary skill in the art would have found the claimed extruded niobium billet obvious on the alleged grounds that tantalum and niobium belong to the same group of metals in the Periodic Table and exhibit very similar properties. This rejection is respectfully traversed.

Independent claim 37 of the present invention is directed to an extruded niobium billet having a cylindrical shape with a diameter of 2 ½ inches or greater with a L/D ratio of greater than 0.5, that is ingot-derived, has a purity of at least about 99.99% and has the property of having a substantially uniform grain size after extrusion.

The Examiner has not shown that the teachings of Clark et al. regarding tantalum have any relevance to niobium.

Even if the teachings of Clark et al. could be carried over to niobium, the combined references do not teach or suggest the claimed invention for the reasons given above.

In particular, as indicated, Clark et al. does not teach or suggest any extruded niobium billet or any billet wherein the extruded billet is cylindrical in shape and has the properties recited in claim 37, including the purity level, the substantially uniform grain size, and the aspect ratio. As indicated, Clark et al. does not relate to an extruded tantalum or niobium billet having a cylindrical shape and having these properties, but relates to an extruded rectangular bar with no description of uniform grain size. For this reason alone, this rejection should be withdrawn since the secondary references, Friedman et al., as well as JP '180, do not overcome these deficiencies for the reasons provided above and in the response filed June 9, 2006, the comments of which are entirely incorporated by reference herein.

With respect to the Examiner's assertion that niobium is readily substituted for tantalum, the applicants respectfully disagree. If one simply looks at the tantalum industry as well as the



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niobium industry, one will readily see that those skilled in the art do not readily substitute niobium for tantalum. The Examiner has not provided any technical support for this allegation. It is clear, for instance, in the capacitor anode area that niobium is not a proper substitute for tantalum. Tantalum anodes clearly have significantly different capacitor properties from niobium capacitor anodes. Similarly, in the sputter target area, there is no recognition that niobium sputter targets can be substituted for tantalum sputter targets. If this was the case, niobium sputter targets would be readily used since niobium is a metal which is far less expensive than tantalum. Thus, clearly those skilled in the art do not readily substitute niobium for tantalum.

Further, JP '180 relates to a high purity niobium film obtained by sputtering or by vapor deposition. There is no proper motivation for combining this reference with Clark et al. or Friedman et al. In particular, a person skilled in the art would not automatically subject highly pure niobium to the processes of Clark et al. or Friedman et al. Moreover, as discussed above, even using 99.99% pure niobium in the process of Clark et al. or Friedman et al. would not result in the present invention, since these references do not teach or suggest an extruded niobium billet having a cylindrical shape with a diameter of 2 ½ inches or greater and a L/D of greater than 0.5 and that is ingot-derived and has the property of having a substantially uniform grain size after extrusion, as recited in independent claim 37. Accordingly, claim 37 and the claims dependent thereon are not obvious over Clark et al., Friedman et al. or JP '180. Further, as previously indicated, Clark et al. or any of the secondary references do not teach or suggest the starting billet or ingot size recited in the process claims and do not teach or suggest a process that forms an extruded billet with a cylindrical shape. Withdrawal of the rejection is therefore respectfully requested.

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**Rejection of Claim 50 under 35 U.S.C. §103(a) over Clark et al. in view of Friedman et al., further in view of Rerat, and further in view of JP '180**

Claim 50 was rejected under 35 U.S.C. §103(a) as being obvious over Clark et al. in view of Friedman et al. in further view of Rerat and in further view of JP '180. The Examiner stated that the rejection is maintained for the reasons provided in the rejection of claim 15. This rejection is respectfully traversed.

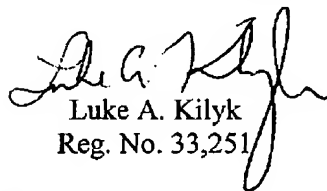
As indicated above, claim 50 has been canceled and, therefore, this rejection is moot.

**CONCLUSION**

In view of the foregoing remarks, Applicants respectfully request the reconsideration of this application and the timely allowance of the pending claims.

If there are any fees due in connection with the filing of this response, please charge the fees to Deposit Account No. 03-0060. If a fee is required for an extension of time under 37 C.F.R. § 1.136 not accounted for above, such extension is requested and should also be charged to said Deposit Account.

Respectfully submitted,

  
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